

Appendix 4 - FPA harvest, as programmed

The FPA analysis differs from the State analysis in that it examines the numbers of trees within a specified slope distance, not horizontal distance, from the stream. It is similar in that it preferentially retains trees closest to the stream.

The annotated FPA rules for Type F streams (629-640-0100)

629-640-0100

General Vegetation Retention Prescription for Type F Streams

- (1) (a) Operators shall apply the vegetation retention requirements described in this rule to the riparian management areas of Type F streams.*
- (b) Segments of Type F streams that are different sizes within an operation shall not be combined or averaged together when applying the vegetation retention requirements.*
- (c) Trees left to meet the vegetation retention requirements for one stream type shall not count towards the requirements of another stream type.*

We applied (1) (a) to the vegetation data as a whole as closely as possible. (b) and (c) did not affect the analysis.

- (2) Operators shall retain:*
 - (a) All understory vegetation within 10 feet of the high water level;*
 - (b) All trees within 20 feet of the high water level; and*
 - (c) All trees leaning over the channel.*

We apply (2) (b) to the analysis but not (2) (a) or (2) (c). We did have tree lean for some trees (towards or away from stream) but no information on whether the lean was over the channel.

- (3) Operators shall retain within riparian management areas and streams all downed wood and snags that are not safety or fire hazards. Snags felled for safety or fire hazard reasons shall be retained where they are felled unless used for stream improvement projects.*

Not applicable to the simulated harvest.

- (4) Notwithstanding the requirements of section (2) of this rule, vegetation, snags and trees within 20 feet of the high water level of the stream may be felled, moved or harvested as allowed in other rules for road construction, yarding corridors, temporary stream crossings, or for stream improvement.*

Not applicable to the simulated harvest.

- (5) Operators shall retain at least 40 live conifer trees per 1000 feet along large streams and 30 live conifer trees per 1000 feet along medium streams. This includes trees left to meet the requirements described in section (2) of this rule. Conifers must be at least 11 inches DBH for large streams and 8 inches DBH for medium streams to count toward these requirements.*

Applied; see description below.

629-640-0100(6) is elaborated on below. Section 629-640-0100(7) is incorporated in the analysis of 629-640-0100(6)(a). We did not apply 629-640-0100(8) through (13).

Data Preparation

The FPA harvest (and all of the harvest files) examine the pre-harvest RipStream vegetation plot cruise data.

The program at first assesses the type of riparian retention to take place at the unit. That is, it needs to determine whether the Type 3 harvest (clearcut) will be 629-640-0100(6)(a, b, or c).

I refer to these three Alternatives as Alt A, B, and C.

It sets a no-cut distance of 20' for all sites, except for medium Alt C streams.

Stream sizes are obtained from a file.

We considered only the treatment reach plots (plots 1 & 2) .

All trees are removed from consideration that have DBH<6".

Finally, I reduced the data to trees from a single vegetation plot.

Determining harvest fates Alts 6a, 6b, 6c, or No Conifer Harvest

This section of the program determines a "harvest function" to pass the plot data to. The data are not reduced here, just sent on their way to their appropriate destination.

Given the stream size (medium or small) the overall file was reduced to include all trees within 70' (Medium) or 50' (Small).

Standard targets. These were set to BA = 60' or 20' for medium or small streams in the coast range. Site 7353 was in the interior and a medium stream, so its' standard target was set to 70. Notice these targets are 50% of what they should be. This is because our plots were 500' long, not 1000'.

I then ranked all trees by distance, with 1 being closest to the stream. A random number between 0 and 1 was associated with these distances to break ties.

Next, to figure out how much snag and hardwood basal area is available & usable to substitute for conifer basal area, I determine the basal area of all conifers within the RMA, the basal area of conifer snags with heights > 30, and the basal area of non-(red) alder, non-conifer, non-snag hardwoods > 20' from the stream and 24" DBH or greater. I determined whether the conifer basal area within the RMA was > or = 90% of the standard target, if the available snag & hardwood basal area was > 10% of the standard target, and finally the percent that snags and hardwood contribute can contribute to the standard target (max of 10%).

The number of non-snag conifers with DBH > 8" are tallied as well.

Harvest Alt 6a:

If the conifer standard target can be met or exceeded then 6a is selected.

Harvest Alt 6b:

If conifer basal area is > 50% but < 100% of the standard target then 6b is selected.

Harvest Alt 6c:

If <50% of the standard target may be met with conifer basal area then 6c is selected.

No Conifer Harvest:

If the stream size is "medium" and there are fewer than 15 8" DBH conifers within the 500' section of RMA (30 per 1000') then no conifer harvest of the RMA is permitted.

Once a harvest alternative is selected, the stand data are passed on to the appropriate function.

The harvest functions determine which trees stay and which trees are harvested.

Harvest Alt 6a

- (6) Operators shall retain trees or snags six inches or greater DBH to meet the following requirements (this includes trees left to meet the requirements of sections (2) and (5) of this rule):
- (a) If the live conifer tree basal area in the riparian management area is greater than the standard target shown in Table 2 [on page 49] where the harvest unit will be a harvest type 2 or type 3 unit (as defined by ORS 527.620), or Table 3 [on page 50] where the harvest unit will be a harvest type 1, partial harvest, or thinning, operators shall retain live conifer trees of sufficient basal area to meet the standard target.
- (7) In the Coast Range, South Coast, Interior, Western Cascade, and Siskiyou geographic regions, hardwood trees and snags six inches or greater DBH may count toward the basal area requirements in subsection (6)(a) of this rule as follows:
- (a) All cottonwood and Oregon ash trees within riparian management areas that are beyond 20 feet of the high water level of large Type F streams, may count toward the basal area requirements.
 - (b) Up to 10 percent of the basal area requirement may be comprised of sound conifer snags at least 30 feet tall and other large live hardwood trees, except red alder, growing in the riparian management area more than 20 feet from the high water level and at least 24 inches DBH.

We attempted to program the harvest procedure to be as true to (6) (a) as possible and to incorporate available basal area according to (7). The code involved largely attempted to determine which trees were necessary to meet the 30 per 1000' of stream (for Medium streams) and if the standard target was met, using as much basal area credit as was possible from conifer snags and large non-alder hardwoods >20' from the stream's edge and 24" DBH or greater. We assumed a Type 3 harvest (clearcut) would take place.

The first task is to determine 30 live conifers per 1000' of medium stream. The distance ranks from above are used to rank all 8" or greater conifers. Also, the number of these types of conifers is recorded.

Next, the code selects which conifer snags or large hardwood trees to retain and count towards the standard target. All possible trees are identified, and then they are ranked by distance from stream and their total basal area contribution summed. Then the basal area of these hardwoods and snags is summed for each of these trees and all qualifying snags/hardwoods closer to the stream. The program finds out the minimum basal area sum that is sufficient to meet or exceed 10% of the standard target (in this case, 2 or 6 square feet of BA for small and medium streams, respectively. $2 \times 2 = 4 = 10\%$ of 40' for small streams; $6 \times 2 = 12$ or 10% of 120'). If there is < 10% of the standard target that can be met by conifer snags and hardwoods, then the basal area of all contributing hardwoods and snags is recorded. The code also records the amount by which the standard target may be reduced for conifer.

Similar to the conifer snags and hardwood, conifers are ranked by distance from the stream and then their cumulative basal area summed, by tree. The tree with the cumulative basal area value (to and including that tree) greater than the standard target minus the snag/hardwood reduction amount is identified.

Next we go to the tree selection process.

Conifer trees are not harvested if:

- It is one of the 15 8" conifers necessary to meet stem number requirements along "medium" streams (30/1000)
- It is one of the conifer snags or large hardwoods identified to meet the standard target amount
- It is one of the identified conifers necessary to meet the standard target

- The tree is \leq the no-cut width.

All hardwoods to 20' of the channel are removed.

Of note, aside from particularly large non-alder hardwoods $> 20'$ from the channel and all hardwoods within 20' of the channel, ALL hardwoods are harvested from the RMA. This is not true if there are fewer than 15 conifers $> 8''$ DBH (which would have triggered the No Conifer Harvest prescription).

The plot data at this point has some extra columns, that identify which trees are to be kept and which are not. This information is sent on to the **plot summarization** function and to the **tree fate** function. We re-insert all snags into the tree fate data set, but keep the snags out of the plot summarization data set.

Harvest Alt 6b

(6) Operators shall retain trees or snags six inches or greater DBH to meet the following requirements (this includes trees left to meet the requirements of sections (2) and (5) of this rule):

- (b) If the live conifer tree basal area in the riparian management area is less than the standard target (as shown in Table 2 where the harvest unit will be a harvest type 2 or type 3 unit, or Table 3 where the harvest unit will be a harvest type 1, partial harvest, or thinning) but greater than one-half the standard target shown in Table 2, operators shall retain all live conifer trees six inches DBH or larger in the riparian management area (up to a maximum of 150 conifers per 1000 feet along large streams, 100 conifers per 1000 feet along medium streams, and 70 conifers per 1000 feet along small streams).*

Harvest 6b differs from 6a in that snags and hardwoods may not count towards the standard target, as the standard target will by definition not be met. Similar to 6a, 30 conifers $> 8''$ DBH are needed per 1000' of stream channel, so the program ranks 8'' conifers by their distance to the stream and determines how many there are. It ranks 6'' and greater conifers by their distance to the stream, and determines their number. Conifers that may be harvested in excess of 150/1000' for Medium streams and 70/1000' for Small stream. All hardwoods to 20' of the channel are removed.

The program:

First, all non-snag conifers $\geq 8''$ DBH are counted and ranked, as they were in 6a.

All conifers 6'' DBH and greater are counted and ranked as well (a different ranking system than the 8'' + trees).

Tree selection process:

- All trees within the no-cut distance are retained
- If a stream is a Medium, the 15 closest conifers with a DBH $\geq 8''$ are kept
- If a stream is a Small, the 35 closest 6+'' DBH trees are kept; if the stream is Medium the tree number is increased to 50

Similar to 6a, the altered plot data are sent on to the **plot summarization** function and to the **tree fate** function. We re-insert all snags into the tree fate data set, but keep the snags out of the plot summarization data set.

Harvest Alt 6c

(6) Operators shall retain trees or snags six inches or greater DBH to meet the following requirements (this includes trees left to meet the requirements of sections (2) and (5) of this rule):

(c) If live conifer tree basal area in the riparian management area is less than one-half the standard target shown in Table 2:

- (A) Operators may apply an alternative vegetation retention prescription as described in OAR 629-640-0300 where applicable, or develop a site specific vegetation retention prescription as described in OAR 629-640-0400; or
- (B) Operators shall retain all conifers in the riparian management area and all hardwoods within 50 feet of the high water level for large streams, within 30 feet of the high water level for medium streams, and within 20 feet of the high water level for small streams.

(6)(c)(A) which provides prescriptions for catastrophic stand damage events and conversion of hardwood dominated RMA is not applicable to the simulated harvest.

For plot data passed on to the function for 6c(B), all conifers within the RMA are retained (we started with trees of 6" DBH or greater, so our data and the criteria above coincide). We use two no-cut distances in this function, set to 20' for Small streams or 30' for Medium streams. All hardwoods are harvested beyond these points by the program.

Tree selection process:

- All trees within the no-cut distances (20' or 30') are retained
- All conifers 6+" DBH are retained within the RMA

Similar to 6a, the altered plot data are sent on to the **plot summarization** function and to the **tree fate** function. We re-insert all snags into the tree fate data set, but keep the snags out of the plot summarization data set.

No Conifer Harvest

If there are fewer than 15 8+" conifers in the RMA then conifers in the entire RMA remain unharvested. All trees and snags of all species are kept and the plot data are passed on to plot summarization and tree fate. Snags were removed from the basal area of stand data passed to **plot summarization**; all trees were passed on to the function **tree fate**. Note that harvest did occur beyond 70' for medium streams and 50' for small streams.

Plot Summarization

The Plot Summarization takes the appropriately-annotated vegetation plot data (that has now passed through Harvest Type 6a, 6b, 6c, or No Conifer Harvest) and summarizes the remaining basal area. As noted above, the incoming data have been stripped of snags, as snags are not expected to contribute much to shade. The stand data trees are marked as "kept" = 1 or 0, to indicate that the tree is retained or harvested. Summarized data include (within 100' slope distance of the stream, for all "kept" = 1 trees) the basal area of all trees, conifer trees, hardwood trees, all trees expressed in m², the number of all trees, conifers, and hardwoods, and the distance to the retained trees farthest from the stream or (of the five vegetation plot lines) the mean and minimum of the maximum tree distance along each line.

The output file for Plot Summarization provides the information for each plot on a single line.

Tree Fate

The Tree Fate function is a means for storing all of the tree data along with a column for “kept” trees. The idea is to be able to plot the retention patterns for each plot as needed.